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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/716,903	11/19/2003	Tadao Yamamoto	03701/LH	7065
1933 7590 03/08/2007 FRISHAUF, HOLTZ, GOODMAN & CHICK, PC 220 Fifth Avenue 16TH Floor NEW YORK, NY 10001-7708			EXAMINER MERKLING, MATTHEW J	
			ART UNIT	PAPER NUMBER
			1709	
SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
3 MONTHS		03/08/2007	PAPER	

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

## Office Action Summary

### Application No.

10/716,903

### Applicant(s)

YAMAMOTO, TADAO

### Examiner

Matthew J. Merkling

### Art Unit

1709

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 11/19/2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☒ Claim(s) 16 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
- Paper No(s)/Mail Date 11/19/2003, 06/06/2006.

- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Objections*

1. Claim 16 is objected to because of the following informalities: the first line states "A chemical comprising:" which should be "A chemical reactor comprising:".

Appropriate correction is required.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-10 are rejected under 35 U.S.C. 102(b) as being anticipated by Hiroshi (JP 2001-228159).

Regarding claim 1, Hiroshi discloses a chemical reactor comprising:

A pair of substrates joined to each other (Drawing 3 (11, 17));

a micro (70 micrometers, paragraph 18) flow path (Drawing 1 (14))

provided between the substrates; and

an injection section (Drawing 4) which injects and supplies a material into the flow path (paragraph 21).

Regarding claim 2, Hiroshi discloses the injection section being supplied from a material storage container provided outside the substrates (paragraph 21).

Regarding claims 3-8, the limitations of these claims do not impart any additional structure to the claimed invention. The material worked on does not limit an apparatus claim. See MPEP § 2115.

Regarding claim 9, Hiroshi discloses the injection section including an inkjet head (paragraph 21).

Regarding claim 10, Hiroshi discloses the injection section which includes an injection mechanism which injects the material in a nozzle (Drawing 5) by pressure due to vapor produced in the nozzle by film boiling through heating the material in the nozzle (paragraph 23).

4. Claims 16 and 18 are rejected under 35 U.S.C. 102(e) as being anticipated by Markoski et al. (US 2003/0134163 A1).

Regarding claim 16, Markoski discloses a chemical reactor (Fig. 7 (20)) comprising:

A microreactor (20, with a microchannel (26) for microfluidic fluidic flow) which causes an oxidative reaction ( $\text{CH}_3\text{OH} + \frac{3}{2}\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ , paragraph 8) in a furnace (microchannel (26)); and

an oxidizing agent supply section (see Fig. 7 (oxidant pump)), which supplies a liquid oxidizing agent (such as hydrogen peroxide, paragraph 50) into the furnace (paragraph 61).

Regarding claim 18, the limitation of this claim does not impart any additional structure to the claimed invention. The material worked on does not limit an apparatus claim. See MPEP § 2115.

### ***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiroshi as applied to claim 1, and further in view of Shioya et al. (US 6,777,118).

Regarding claims 11 and 12, Hiroshi discloses all of the claims limitations as discussed with regard to claim 1 above, but does not teach a heat source for heating the flow path or the heat source being a thin film heater.

Shioya teaches a microreactor (Fig. 84) including a micro flow path (204) that is used to generate hydrogen for a fuel cell (see abstract).

Shioya also teaches a heat source (Fig. 84, (206)) as a thin film heater, which heats the said flow path (col. 103, lines 9-14) in order facilitate forming vapors of reactants introduced into said microreactor (col. 102 line 65 – col. 103 line 14).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the microreactor of Hiroshi and the heat source of Shioya in order to facilitate the vaporization of reactants in the microreactor.

7. Claims 13-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiroshi and Shioya as applied to claim 11 above, and further in view of Tonkovich et al. (US 6,969,506).

Regarding claim 13, the modified Hiroshi fails to teach a heat source with a fluid to be supplied in a flow path provided in a surface of one of the pair of substrates which is opposite to a surface facing the other substrate.

Tonkovich also teaches a microreactor (Fig. 8) that contains microchannels where reactions are carried out (col. 1 lines 50-54).

Tonkovich teaches a fluid (air or hydrogen, col. 30 lines 58-62) which will be the heat source (when it is combusted) supplied in a flow path (Fuel, Fig. 8) provided in a surface on one of the pair of substrates, which is opposite to a surface facing the other substrate (See Fig. 8).

Tonkovich teaches this heat source in such an orientation in order to facilitate the exchange of heat from an exothermic reaction (combustion) to drive an endothermic reaction (such as steam reforming) (col. 1 lines 54-59).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the microreactor of Hiroshi with the orientation and heat source of Tonkovich in order to facilitate the exchange of heat from an exothermic reaction to drive an endothermic reaction.

Regarding claims 14 and 15, the modified Hiroshi fails to teach a heat source with a combustion reaction furnace further comprising an injection section which injects and supplies the combustion fuel.

Tonkovich teaches a heat source coming from a combustion reaction (col. 1 lines 50-54) and exchanging heat with a separate reaction, such as an endothermic reaction, in order to provide heat to drive the endothermic reaction (col. 1 lines 56-59).

Tonkovich also teaches a fuel injection section that injects and supplies the combustion fuel (col. 30 lines 45-48). Tonkovich teaches this 'distributed' fuel injection section to evenly inject fuel into a combustion channel in order to supply fuel for the combustion reaction (col. 30 lines 60-64).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the microreactor of Hiroshi with the combustion furnace and fuel injection system of Tonkovich in order to combust the fuel, create heat energy and drive an endothermic reaction.

8. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Markoski as applied to claim 16 above, and further in view of Strand et al. (US 2002/0176804 A1).

Markoski discloses all of the structure as discussed with regard to claim 16 above, but fails to teach an inkjet head in the oxidizing agent supply section.

Strand teaches a microfluidic device (5) that can be used for reacting reagents (paragraph 8, bottom third) in microchannels.

Strand also teaches a piezoelectric driven pump to supply liquids to the microchannels at low flow rates (paragraph 46, bottom third). One skilled in the art would recognize that an inkjet head is a piezoelectric pump, as is shown by Blanchard (US 6,384,210) (col. 1 lines 60-67).

Strand teaches this inkjet head in order for a pumping section to be bubble and particle tolerant when pumping liquids (paragraph 46, bottom third).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the inkjet head (piezoelectric pump) of Strand with the microreactor of Markoski in order for the pumping section to be more tolerant to bubbles and particles.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Merkling whose telephone number is 571-272-9813. The examiner can normally be reached on Monday - Friday 8:30-4:30pm EST.




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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa D. Neckel can be reached on 571-272-9827. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



MJM

  
ALEXA D. NECKEL  
SUPERVISORY PATENT EXAMINER